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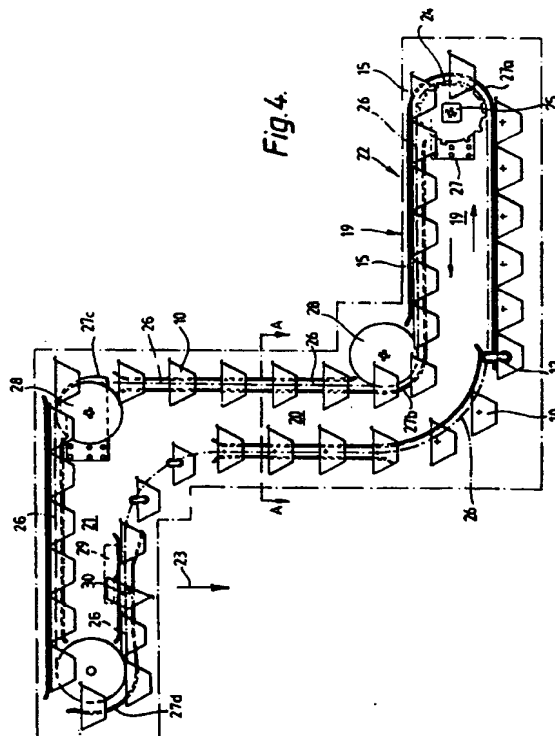
Applicant: Gough & Company (Hanley)  
 Limited  
 Clough Street, Hanley  
 Stoke on Trent, Staffordshire(GB)

Inventor: Gough, George Terah  
 51 Caboose Ct.  
 Charlotte N. Carolina(US)

Representative: Carpmael, John William  
 Maurice et al  
 CARPMAELS & RANSFORD 43 Bloomsbury  
 Square  
 London, WC1A 2RA(GB)

Conveyor or elevator system.

A conveyor or elevator system of the type that comprises a series of buckets (10) supported by a driven chain (15) or the like to move the buckets - (10) along a predetermined path. It is desirable in such systems to have the buckets (10) arranged close together and very often the buckets are interlocked or overlapped. It is also desirable to enable the buckets (10) to be maintained in a substantially horizontal attitude at all times. The invention enables these objects to be achieved. In Figure 4 is shown a bucket elevator in which a continuous driven chain - (15) supports inter-engaging buckets (10) on swinging links (12). The links (12) carry rollers (11) which travel along guidance tracks (27,27a,27b,27c,27d) which diverge at bends from a track (26) which guides the chain (15). Thus the buckets (10) pass around a curve of greater radius than the chain due to movement of the swinging links (27) and will separate and remain horizontal.



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## CONVEYOR OR ELEVATOR SYSTEM

This invention relates to a conveyor or elevator system of the type that comprises a series of buckets supported by one, or a pair, of driven chains, cables, belts, ropes or other endless entrainment means (hereinafter called chain-type) to move the buckets along a predetermined path. It is desirable in such systems to have the buckets arranged close together and very often the buckets are interlocked or overlapped.

It is also desirable to enable the buckets to be maintained in a substantially horizontal attitude at all times.

When the buckets go round corners or negotiate turns, horizontally or vertically, if the buckets are interlocked or overlapped or even if they are very close together there is a tendency for the buckets to tip.

An object of the invention is to provide an elevator or conveyor system in which this difficulty is overcome and in which the buckets may be arranged to assume a horizontal attitude at all times. Another object of the invention is to provide a chain-type elevator/conveyor which can be operated at a greater speed than known chain-type conveyors and yet which is less expensive to manufacture and maintain.

In accordance with the present invention, an elevator or conveyor system comprises a series of buckets supported by a driven chain (or other endless entrainment means) along a predetermined path, each bucket being supported on the chain by means of at least one swinging link, guidance means being provided at at least some of the curves or bends in the path to cause the links to swing outwardly away from the chain so that the buckets in turn move outwardly and follow a curve of greater radius than the radius of the curve or bend in the path, whereby the buckets are spaced further apart when going round such curve or bend than when they are proceeding along a straight portion of the path. Preferably, the buckets are supported from two chains, one being located on each side thereof, by a pair of swinging links.

Preferably, the buckets are arranged to be very close together or touching or overlapping or even interlocked along the straight portions of the path but to separate when the buckets go round a curve or bend.

Preferably, the buckets are maintained in a substantially horizontal attitude at all times.

Preferably, each link is provided with a follower roller which may engage in a track which may run parallel to the path of the chain or cable along the straight sections but which is diverted outwardly away from the normal run of the chain at two curved sections.

If a chain is employed it may have rollers or wheels at intervals along its length to engage a track to guide the chain.

Means may be provided to empty the buckets comprising a cam located alongside the path of the chain and a corresponding cam follower or arrangement of pegs on each bucket to cause the bucket to tip and empty when the cam follower or pegs engage(s) the cam. Preferably, the cam and followers or pegs are designed to tip the buckets through about 125° and then tip them back to their upright position.

From another aspect, a bucket elevator comprises a plurality of buckets carried by individual links pivoted on a driven chain arranged to follow a path comprising straight and curved sections, each link having a follower roller engaged in a guide track extending over at least part of the path, the track having sections which divert the follower rollers away from the normal path of the chain at at least one of the bends in the path so that the links will be caused to pivot and thus move the buckets away from the path of the chain whereby the buckets follow a curve of greater radius than the chain at said at least one bend.

Preferably, each of the swinging links is connected to a bucket by means of a bucket pin and the pin carries the follower roller. The rollers which are employed for chain guidance may be carried on a shaft which performs the additional function of acting as the pivot point for the swinging link where it is pivoted to the chain. The shaft may pass through a pair of links and form the means of hingeing the links together.

The invention is preferably applied to a bucket elevator of the self-contained type which is provided with one or more loading station(s) and unloading station(s) and a driven chain or pair of chains having a vertical section so as to raise the buckets from the loading station(s) to the unloading station(s).

Two embodiments of the invention are now described by way of example with reference to the accompanying drawings, in which:-

FIGURE 1 is an end elevation of an elevator bucket for use with an elevator or conveyor system in accordance with the invention;

FIGURE 2 is a plan of the same bucket;

FIGURE 3 is a horizontal section through a portion of a chain of a bucket elevator having a single chain and shows the way in which each bucket is pivoted to the chain by a swinging link;

FIGURE 4 is a schematic side elevation of the whole bucket elevator showing the buckets supported from a chain;

FIGURE 5 is an end elevation of the elevator shown in Figure 4;

FIGURE 6 is a section on line A-A of Figure 4;

FIGURE 7 is a horizontal plan through a bucket of a twin chain unit in accordance with a second embodiment of the invention;

FIGURE 8 is a vertical section through the twin-chain unit;

FIGURE 9 is a partly schematic side elevation showing one way of how a bucket is tipped as it is advanced; and

FIGURES 10-12 are views similar to Figures 1, 2 and 9 and showing an alternative embodiment of bucket and tipping arrangement.

As seen in Figures 1, 2 and 3, each bucket 10 of the bucket elevator carries a trunion 13 and is pivoted by a bucket pin 14 to a swinging link 12. The bucket pins 14 each carry a roller 11 for contact with guidance means or a cam track as will be described later.

A single driven chain 15 has a shaft 16 passing through the junction of a pair of links of the chain. The swinging link 12 is pivoted to one end of the shaft 16 and the shaft also carries a pair of follower rollers 17, 18. The assembly of shaft and swinging link is repeated every fourth link in the chain so as to support the buckets as illustrated in Figure 4.

The bucket elevator shown in Figure 4 comprises a horizontal section 19, a vertical section 20 and an upper horizontal section 21. Material to be handled is loaded into the buckets 10 at loading station 22 and discharged at discharge section 23.

The chain 15 is driven in known manner from an electric motor or the like, a chain tensioner being shown at 25.

Follower rollers 17, 18 run in a closed track 26 and follower rollers 11 run around selected parts of the path of the conveyor along tracks and cams 27a, 27b, 27c, 27d; at curved parts of the conveyor path, cam tracks 27a and 27c are arranged to diverge away from track 26 (see Figure 4).

When the buckets are proceeding along a straight portion such as horizontal section 19 or a vertical portion such as 20, the swinging links 12 will remain parallel with the track 26 but when the tracks diverge as at 26, 27a, and 26, 27b, the rollers 11 will follow the diverging paths and cause the links to swing so that the buckets 10 move away from track 26 in an outward direction. As seen at 27a, the curved path created by the diverg-

ing portion of the track 27a is of greater radius than the track 26. The track portion 27a is provided by a curved surface on a cam plate 27 bolted to the conveyor frame. Thus the buckets 10 are caused to follow the curve of greater radius and therefore separate from each other during their passage round the bend. The buckets can thus proceed round the bend whilst maintaining their horizontal attitude without interfering with each other.

The curved diverging portion of track at 27c may be formed by a circular plate 28 of greater diameter than the sprocket round which the chain is carried; at 27d it may be formed by an arcuate plate against which the follower rollers can fall under gravity. Each of the curves may be configured in a similar way so that at the corners, the paths 27a-27d diverge from the path 26. The particular shape of the diverging track part will depend upon the curvature of the bend and other factors.

At the discharge station 23, a cam follower 30 - (see Figures 4 and 9) located on each bucket contacts a discharge ramp or cam 29 causing the bucket to tip and discharge. The cam is so arranged as to cause the bucket to pivot through about 135° and dislodge its load, and then tip back again. For this purpose, each cam follower is of a generally triangular configuration (see Figure 9) or equivalent, and the cam 29 initially tips the bucket over by one side edge 31 of follower 30 hitting the cam 30 at 32, and as the buckets are advanced upside down, so the adjacent edge 33 will hit a further cam surface 34 on the cam 29, and right the bucket again. The ramps or tipping cams 29 can be at one or several different positions and can be remotely controlled through air cylinders or hydraulic rams or solenoids or actuators of various types.

Filling can take place at any horizontal position as the buckets are always in close proximity to each other or overlapped on all horizontal runs.

Because the buckets are always substantially horizontal, except when being emptied, any material that remains in the bucket after it has been emptied will not fall out during the return of the buckets to the filling position as happens in known elevators where the buckets very often return in an inverted position to the filling station.

The chain shown in Figure 3 may be a hollow bearing pin type chain made in carbon steel, stainless steel or treated carbon steel. The rollers 17, which are of greater diameter than the chain link depth, can be in carbon steel, stainless steel, nylon or other materials which will assist in lubrication and maintenance aspects.

A single chain can be used as shown in Figures 1-6 or a twin chain unit may be used, as shown in Figures 7 and 8. The twin chain unit is fitted with buckets having a trunnion on each side face, supporting respective bucket pins 14 and swinging links 12, each of which is pivotally supported on a chain 15 by a shaft 16. Follower rollers 17 are provided on the shafts 16, which engage a track 26 as in the previous embodiment.

Referring now to Figures 10-12, a modified bucket 10' is shown which has the same trunion 13 and bucket pin 14 as in the previous construction but has a modified cam follower arrangement to cause it to tip in the manner shown schematically in Figure 12. On the top edge of the bucket a first pin 300 is supported on a projecting ear 302 and near the bottom of the bucket near its trailing edge a second pin 304 is provided.

Referring now to Figure 12 which shows a bucket advancing in an opposite direction to Figure 9, a discharge cam 306 is provided which is engaged by the pin or cam follower 300 on the bucket 10' as the bucket is advanced to cause tipping of the bucket and a further cam 308 downstream of the cam 306 is provided which is engaged by the pin or cam follower 304 to right the bucket again after tipping of its contents. As can be seen from Figure 12, when the cam follower 300 engages the leading face of the discharge cam 306, the bucket is tipped through about 100° rapidly and it is then maintained in this position by gravity while its contents are discharged and the bucket advances. After the bucket has advanced a short distance, the cam follower 304 hits the leading edge of the further cam 308 which has the effect as the buckets are advanced of tipping the bucket back through about 20° and while this is occurring the cam follower pin 308 is carried over a horizontal face 310 of the cam 308 and is then allowed to slide down a trailing face 312 while the bucket rights itself again. It will of course be appreciated that this design of bucket tipping mechanism is equally applicable to single or double chain bucket elevators and the tipping mechanism can be provided on one or both sides of the pockets.

Although as shown applied to a bucket elevator the principles of this invention may equally well be applied to any conveyor system where buckets or other conveyor devices have to pass around bends. Of course, the buckets, instead of being supported by one or a pair of chains 16, may be supported by any other type of endless entrainment means, such as a rope(s), cable(s) or belt(s).

It will of course be understood that the present invention has been described above purely by way of example and modifications of detail can be made within the scope of the invention.

## Claims

1. An elevator or conveyor system comprising a series of buckets supported by a driven chain (or other endless entrainment means) along a predetermined path, characterised in that each bucket (10) is supported on the chain (15) by means of at least one swinging link (12), guidance means (27a, 27b, 27c, 27d) being provided at at least one of the curves or bends in the path to cause the links (12) to swing outwardly away from the chain (15) so that the buckets (10) in turn move outwardly and follow a curve of greater radius than the radius of the said one curve or bend in the path, whereby the buckets (10) are spaced further apart when going round said at least one curve or bend than when they are proceeding along a straight portion of the path.

2. An elevator or conveyor system according to claim 1 characterised in that the buckets (10) are supported from a pair of chains (15), one being located on each side of the buckets (10), by a pair of swinging links (12).

3. A system according to claim 1 or 2 characterised in that the buckets (10) are arranged to be close together along the straight portions of the path but to separate when the buckets (10) go round said curve or bend.

4. A system according to claim 1, 2 or 3 characterised in that the buckets (10) are maintained in a substantially horizontal attitude at all times.

5. A system according to any one of claims 1-4 characterised in that each link (12) is provided with a follower roller (11) and which may engage in or with a track (27a, 27b, 27c, 27d) provided for the follower (11), the track normally running parallel to the path of the chain (15) along the straight sections but being diverted outwardly away from the path of the chain (15) at two curved sections.

6. A system according to any one of claims 1-5 characterised in that the chain (15) has rollers or wheels (17,18) at intervals along its length to engage with or in a track (26) provided to guide the chain (15).

7. A system according to any one of claims 1-6 characterised in that means (29,30) are provided to empty the buckets (10) comprising a cam (29) located alongside the path of the chain (15) and a corresponding cam follower (30) on each bucket (10) to cause the bucket (10) to tip and empty when the cam follower (30) engages the cam (29).

8. A system according to claim 7 characterised in that the said means (29,30) are designed to tip the buckets (10) through about 135° and then tip them back to their upright position.

9. A system according to any one of claims 1-6 characterised in that means (300,304,306,308) are provided to empty the buckets comprising a pair of

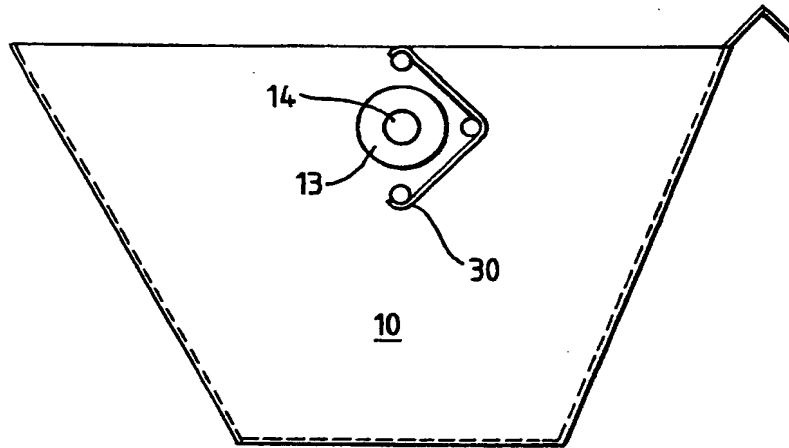
cams (306) and (308) located alongside the path of the chain and two corresponding cam follower pins (300,304) on each bucket, engagement of the pin - (300) with the cam (306) causing tipping of the bucket for emptying and subsequent engagement of the pin (304) with the cam (308) causing the pocket to be righted again.

10. A bucket elevator comprising a plurality of buckets (10) carried by swinging links (12) pivoted on a driven chain (15) arranged to follow a path comprising straight and curved sections, characterised in that each link has a follower roller (11) engageable in or with a guide track (27a, 27b, 27c, 27d) extending over at least part of the path, the track having sections which divert the follower rollers (11) away from the normal path of the chain - (15) at at least one bend in that path so that the links will be caused to pivot and thus move the buckets (10) away from the path of the chain (15) whereby the buckets (10) follow a curve of greater radius than the chain (15) at said bend.

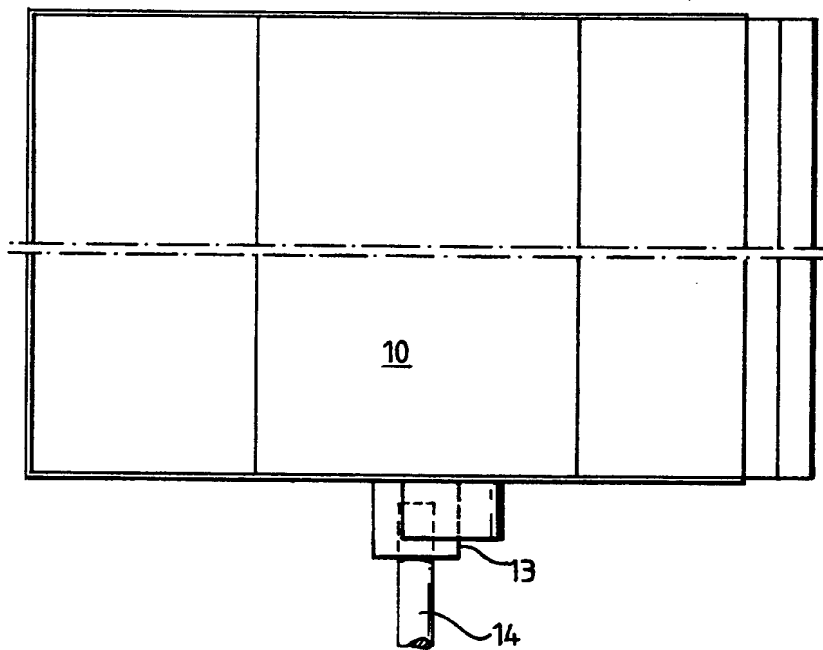
11. An elevator according to any one of the preceding claims characterised in that each of the links (12) is connected to a bucket (10) by means of a bucket pin (14) and in that the pin (14) carries the roller (11).

12. An elevator according to claim 11 characterised in that rollers (17,18) which are employed for chain guidance are carried on a shaft (16) which performs the additional function of acting as the pivot point for the swinging link (12) where it is pivoted to the chain (15).

13. An elevator according to any preceding claim, characterised in that it is of the self-contained type provided with a loading station (22) and an unloading station (23) and a driven chain (15) having a vertical section so as to raise the buckets (10) from the loading station (22) to the unloading station (23).



*Fig. 1.*



*Fig. 2.*

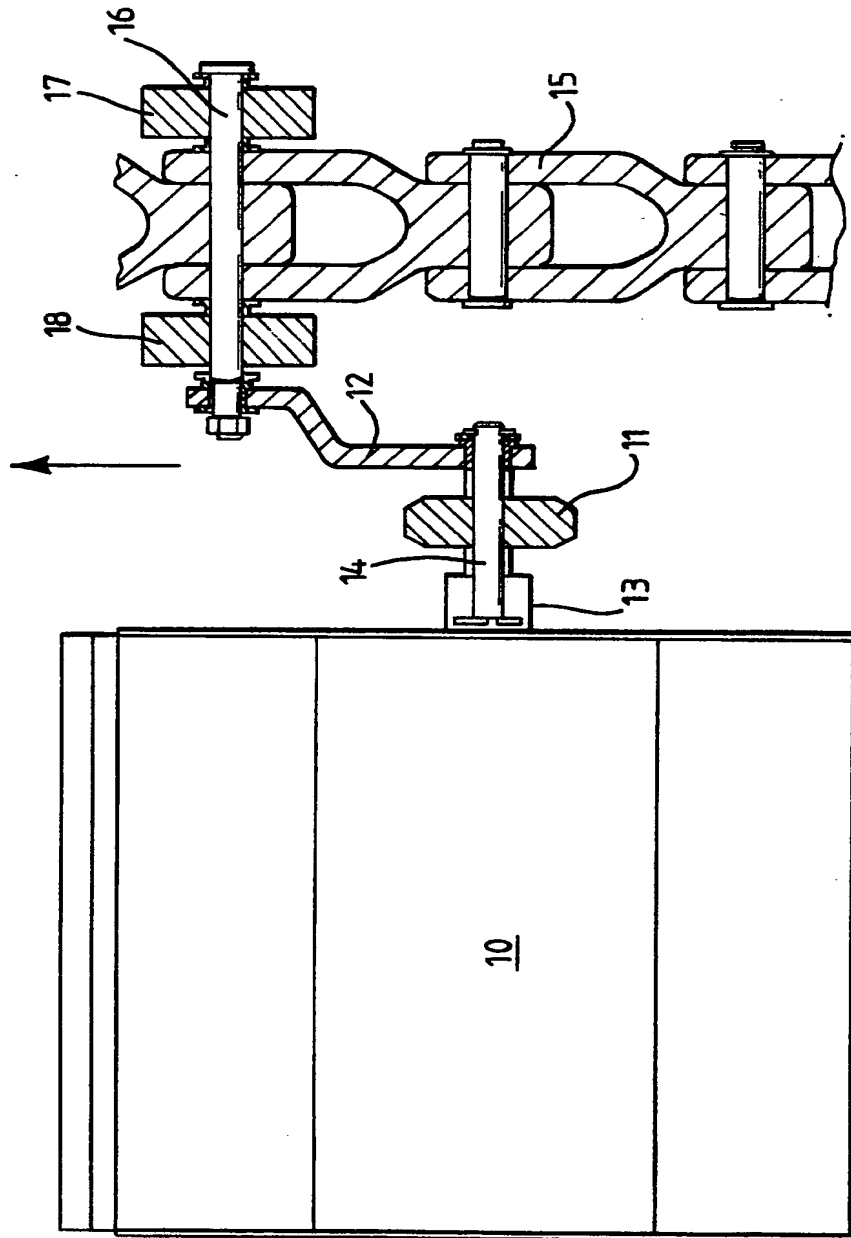
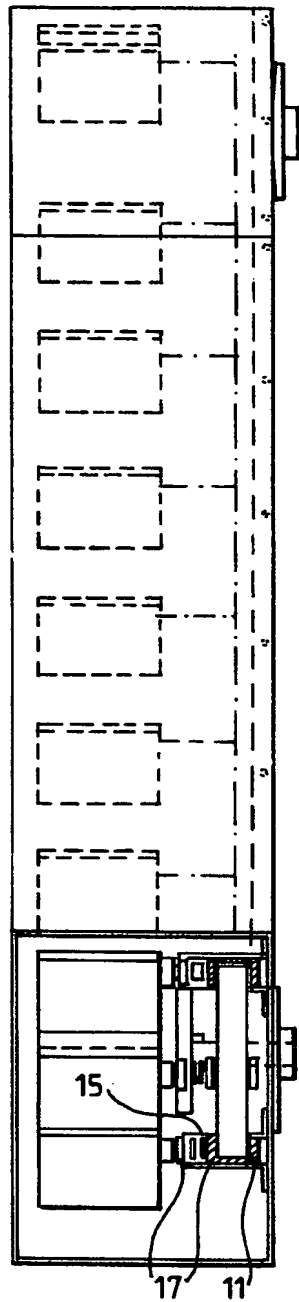


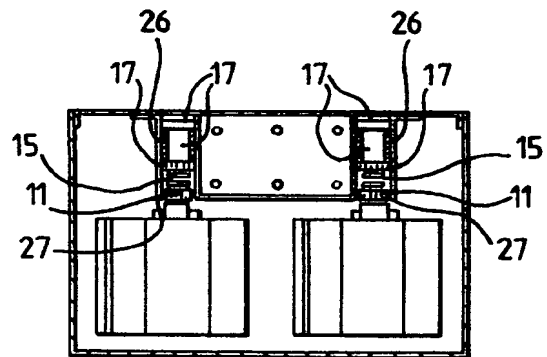
Fig. 3.







*Fig. 5.*



*Fig. 6.*

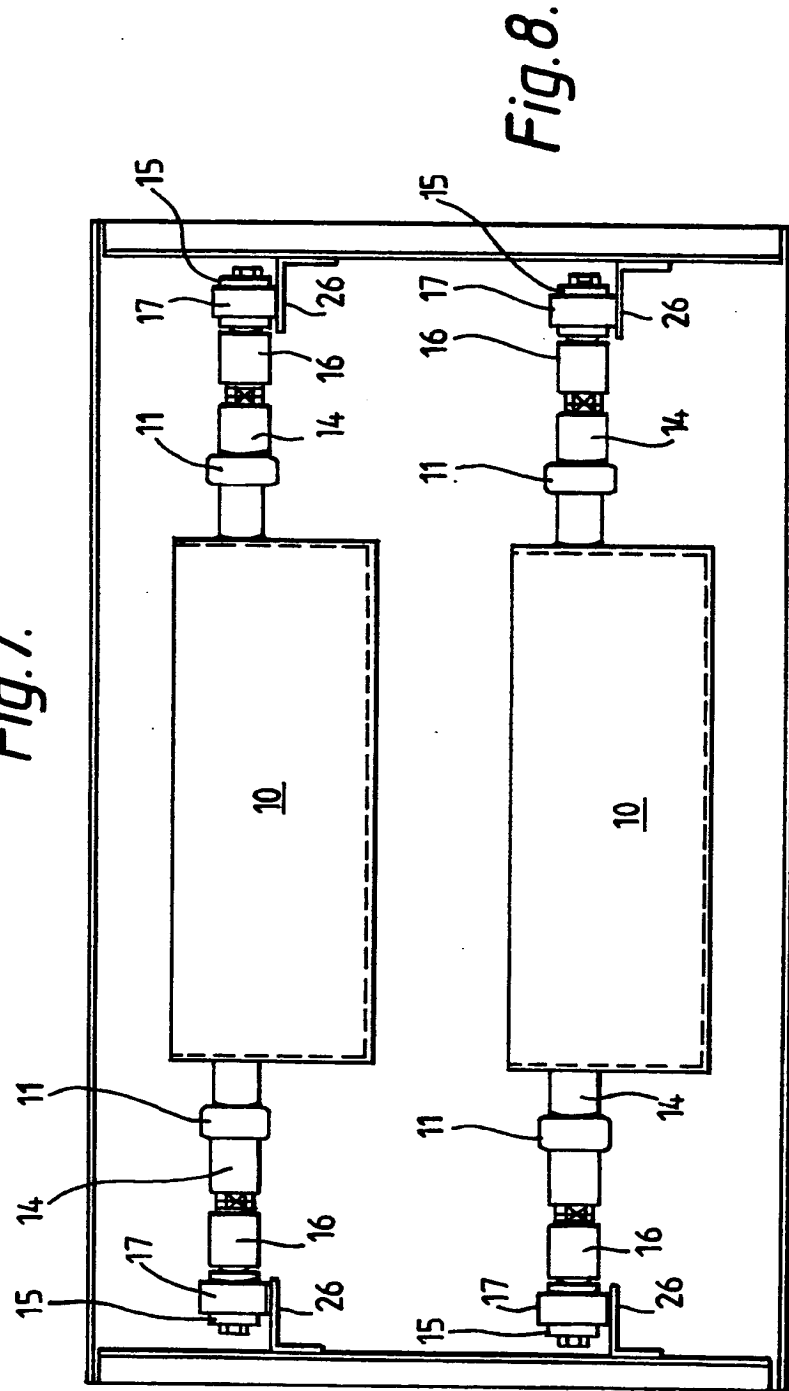
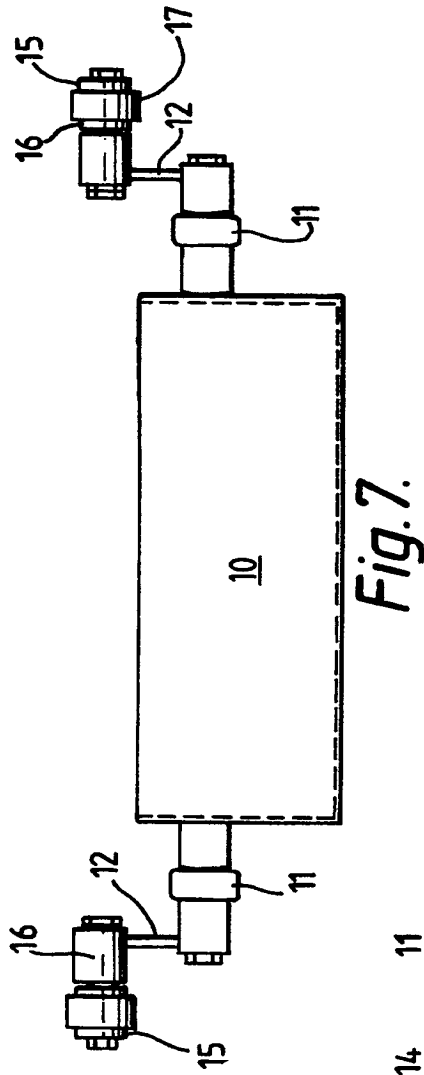
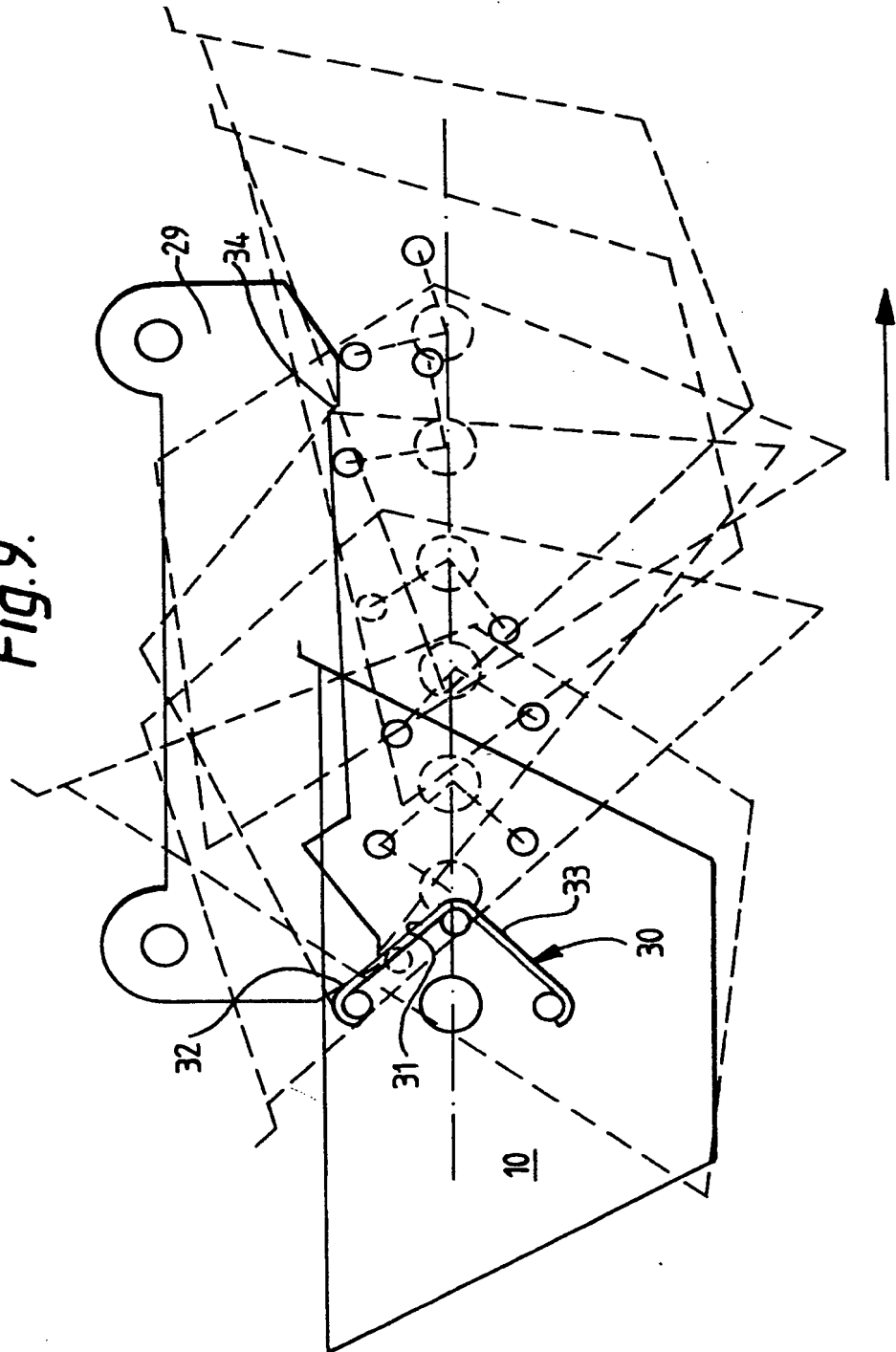


Fig. 9.



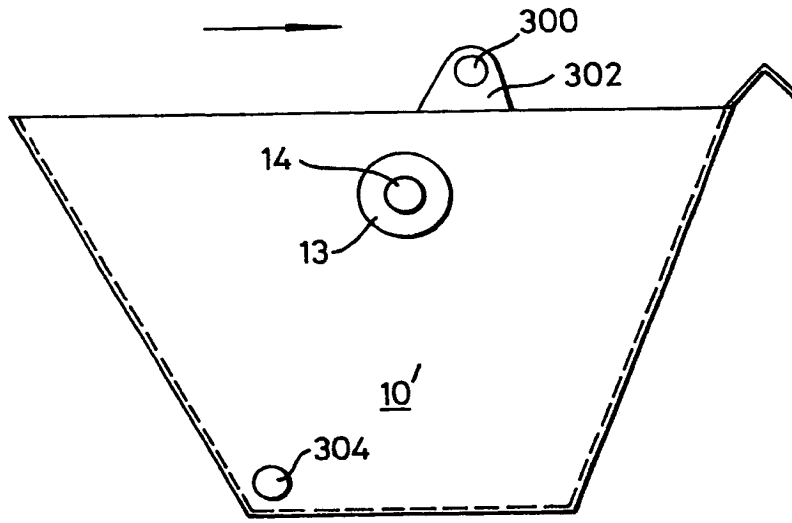
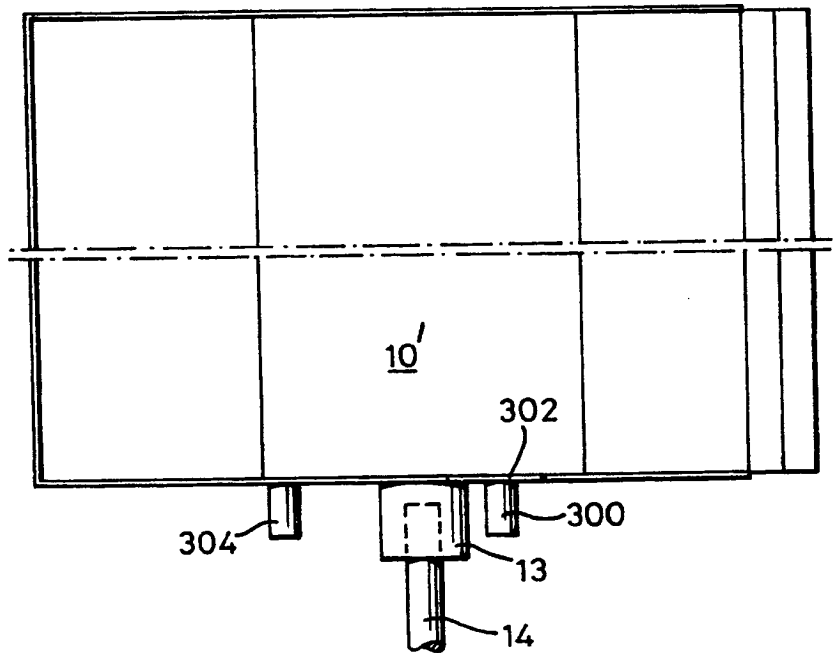
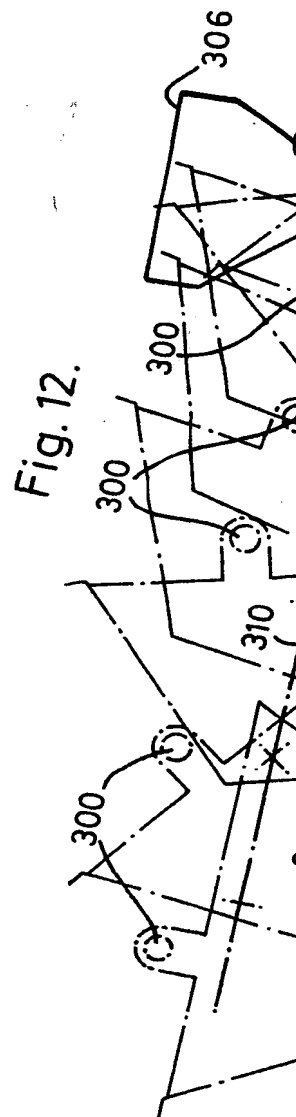


Fig. 10.

Fig. 11.





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# EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 86305643.8
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X	DE - B - 2 242 474 (KALETIN) * Fig. 2,6 *	1-5,10, 11	B 65 G 17/42 B 65 G 47/40
Y	* Fig. 2,6 *	7-9	
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X	US - A - 4 139 092 (YAMANO) * Fig. 6 *	1,4,5, 10	
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Y	DE - B - 1 116 156 (STERKRADE) * Fig. 1 *	7-9	
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A	US - A - 4 232 783 (KRAFT) * Column 3, lines 62-64 *	6	TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
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A	US - A - 4 232 782 (IKEDA) * Fig. 1 *	1,13	B 65 G
	----		
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 15-10-1986	Examiner BAUMGARTNER
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